Fig 1

Fig 2

Fig 3

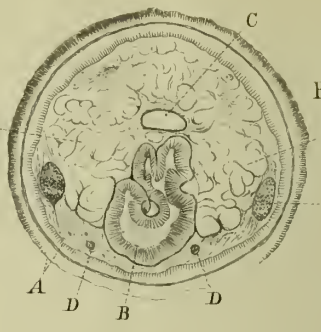


Fig 4

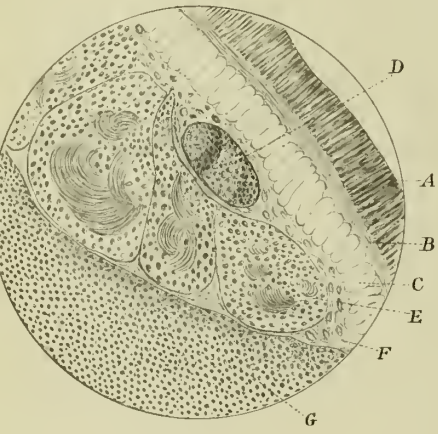


Fig 7

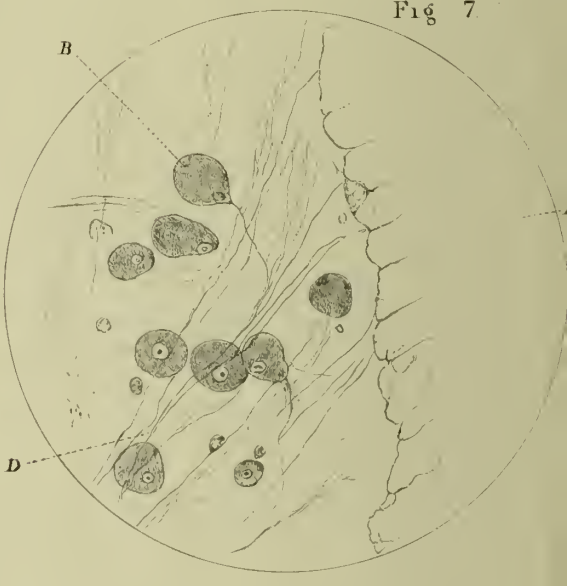


Fig 5

Fig 6

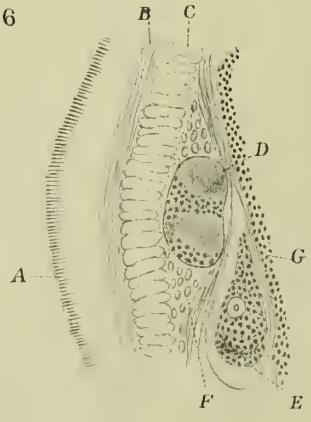
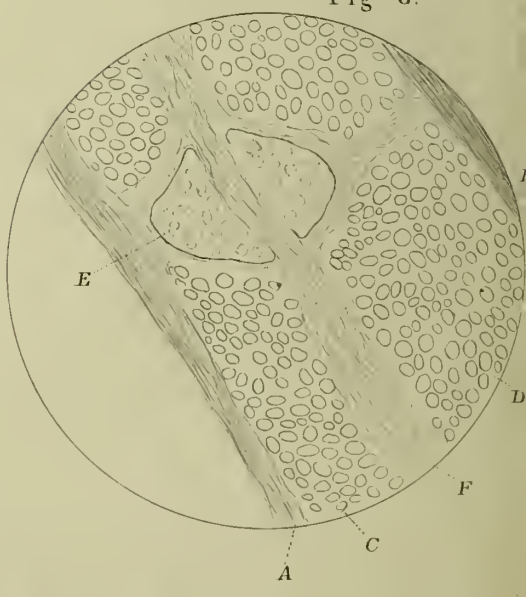


Fig 8.



Turbellaria.—By *George Gulliver, B.A.*
(Plate LV.)

Two forms of considerable interest belonging to this group were found to be tolerably abundant. They belong to the genera *Tetrastemma* and *Geoplana*, and I can scarcely entertain a doubt that these animals will finally prove to have a much wider geographical range, or, in other words, that it would be premature to regard them as peculiar to the island of Rodriguez. I may also express it as my belief, that the Land Planarians are much more numerous than has been supposed hitherto; but, unfortunately, with but few exceptions, Zoologists who have visited this region, have paid but little attention to them.

The species of *Tetrastemma* is, I believe, the third Land Nemertean which has been discovered, one having been found by Semper in the Pelew Islands, and another quite recently by the late Dr. Von Willemoes Suhm in the Bermudas, which he has described in "Annals and Magazine of Natural History," 1873, xiii., p. 309. He expresses it there as his opinion that land Nemerteans are much more common on tropical islands than has commonly been supposed, and the discovery of one at Rodriguez goes a long way towards justifying his supposition. Dr. Suhm's, like mine, is a species of *Tetrastemma* (*T. agricola*), but the present species is much more truly a terrestrial species than his, inasmuch as it occurs in woods—in damp rotten wood—and similar situations. This was the case also with that discovered by Semper. The animal was killed almost immediately by immersion in salt-water, for which it showed its distaste by rapidly exserting its proboscis, as it does when placed in alcohol. Fresh water, on the contrary, was by no means so distasteful to the animal, and I have had them remain alive for a whole night in it. It never, however, was observed to attempt to crawl on the upper surface of the water, though it would ascend the sides of the glass, and, if possible, settle itself outside the water. All the specimens seemed to be exceedingly torpid, and showed no disposition to move. If disturbed in their lodgment in rotten wood they appeared to shrink away into some recess, but never attempted to move for any length of time. It would seem to be very probable that this season was one of torpidity with them.

Tetrastemma rodericanum.—(Plate LV., fig. 2.)

Specific character.—Body narrow, elongated: dorsal surface dark green with a narrow white streak along the median line, and one at each side near the ventral

surface. Ventral surface white. Head of a lighter green colour than the dorsal surface of the body, and having four white spots on the snout, visible when the animal is looked at from before. Marginal stylet sacs four. Cephalic sacs absent.

Habitat.—On rotten wood, under decayed leaves, &c. in the Island of Rodriguez.

The animal is from one to three inches in length. The dorsal surface is convex, the ventral flat. The colour of the dorsal surface is generally a very dark green, but occasionally the shade is a good deal lighter than usual. The lateral white lines are broader than the median one. The head is bifid anteriorly. Of the four white spots one is situated laterally on each lobe of the snout, and of the remaining two, one corresponds to the aperture of the proboscis, and one to the mouth.

Anatomy.—Tetrastemma Rodericanum corresponds very closely in the arrangement of its internal organs with the other members of the Enoplan division. It presents however certain peculiarities which are worthy of mention.

Cephalic fissures and sacs.—No trace of the cephalic fissures or of the sacs to which they lead, could, after careful examination, be detected. This was also the case in the Bermudian Tetrastemma described by Dr. Suhm.

Proboscis.—As in *Amphiporus hastatus*, there are four marginal stylet sacs situated in the same plane. The structure of the proboscis corresponds very closely with that of other members of the group. There is however one respect in which it appears to be peculiar, namely in the possession of an additional system of circular fibres which traverses the great longitudinal columns which constitute the so-called "beaded layer" (Plate LV., fig. 8). As in the other Enopla, each of the great longitudinal bands is surrounded by fibres which are perhaps derived in part from the external, and in part from the internal, circular coats, but the system of fibres just mentioned is additional to these, though mingled with them. It cuts through the longitudinal fasciculi, dividing each fasiculus into an inner and outer half, constituting a distinct circular coat (Plate LV., fig. 9, F). These fibres are wavy, as are also the others just spoken of as surrounding the longitudinal fasciculi. None of the fibres are distinctly traceable among the bundles of longitudinal muscular fibres. Whilst the internal circular and external circular coats, and the external longitudinal and internal longitudinal muscular coats, are readily stained by carmine, the longitudinal elastic bundles, with the fibres which surround, and those which traverse them, do not take the staining fluid at all.

Nervous system.—The general arrangement of the nervous system presents no peculiarities. The distinction between the fibrous and cellular elements in the lateral nerve trunks is, however, remarkable from its clearness and constancy of the arrangement of the two elements. Well marked groups of nerve-cells are present also in the ganglia, and are continuous with the cellular elements of the

lateral cords. Owing to the difficulty of obtaining symmetrical sections of the ganglia, it is very hard to gain anything like a notion of the arrangement of the cells in those bodies. In size and form the ganglionic cells appear to be identical with those of cords, the general arrangement of which can readily be studied in transverse sections. In the present species the cells have a definite arrangement which does not appear to have been the case in any of the species examined by previous writers.

The arrangement is in all the more easy to study, as the cells are deeply stained by carmine or logwood, whilst the fibres are comparatively unstained.

If a transverse section be made through a lateral nerve trunk at any part of the body, appearances similar to those figured in Plate LV. figs. 4, 5, 6, will be seen. The trunk itself is somewhat kidney shaped in section, the convexity being towards the integumental, and the concavity towards the visceral, aspect of the body. It is bound down to the body-wall by well marked fibres. There are seen to be two cell regions, and two fibrillar regions. The uppermost or dorsal cell region (Fig. 6 A.) crosses the cord, obliquely slanting inwards and downwards. Above it, is the upper fibrillar region C., and below it the lower fibrillar region, D. The upper cellular region is, allowing for slight variations, constantly expanded at its external, and to a much less degree at its internal, extremity.

The lower cellular region B. occupies the ventral part of the cord, and is in contact below with the sheath. It has a more or less crescentic form, tending to have its outer horn prolonged to meet the external and lower extremity of the upper cellular region. In some sections the two regions may be seen to meet, but always by a very narrow belt of cells, whilst in most cases the two regions are, as in Fig. 6, separated by the lower fibrillar region. The arrangement here mentioned and figured is so constant that there is never any difficulty in distinguishing the dorsal from the ventral, or the inner from the outer aspect of the cord, in the abscence of any other guide but the arrangement of its cells and fibres. The cells themselves are of small size, granular in structure, and never present an appearance of a distinct nucleus and nucleolus as do those from the ganglia of *Leptoplana* figured by Moseley in the "Phil. Trans.," 1874, Plate XV., nor can any sign of processess arising from them be detected, though in some cases the matrix in which they lie suggests the presence of them from having a fibrillar appearance. Fine bands of fibres, Fig. 6 E., may be constantly seen running into the masses of nerve fibres. They appear to be in a large measure fibrous septa running into these masses, but may in part be fibres derived from the cells, though no distinct evidence of this has been obtained.

With regard to the structure of the fibrillar masses themselves, as might be expected, nothing definite can be made out. In transverse section they appear granular, having the fibres just mentioned running into them at parts.

Eyes.—The eye consists of an anterior clear, and a posterior pigmented, portion. In form it resembles that figured by Leydig as occurring in *Planaria lactea* ("Vom Bau des Thierischen Korpers," pl. I.). In specimens preserved in alcohol, the eye pigment has a tawny brown colour. It was suggested to me by Dr. Rolleston that this might be due to the solvent action of the alcohol, and, accordingly, having examined some specimens which had been preserved in chromic acid, and found the eye pigment of these to be of a deep black colour, it was at once obvious that such was the case. Moseley, *l. c.* p. 121, appears to doubt the solubility of the pigment of Planarians in alcohol, and mentions that it is especially not the case with the eye pigment of *Leptoplana.* Nor is it the case in the planarian, *Geoplana whartoni*, about to be described, nor with regard to the body pigment of the present species of Tetrastemma. It is however most undoubtedly the case that the eye pigment of the latter is soluble in alcohol.

Cephalic Glandular Mass.—Commencing at a very short distance from the snout of the animal, persisting throughout the whole œsophageal region, and, if one may so express it, occupying the space, which after the termination of the œsophagus is filled up by the voluminous digestive tract is a mass, which is here described as glandular, without, it must be confessed, much knowledge as to its true nature. It is figured as it appears under a low power in Pl. LV. fig. 3, F. Under a high power this mass consists of spaces irregular in shape and size, and enclosed by a tissue which is in part homogeneous and in part fibrous. In the spaces thus enclosed there is amorphous granular material, but no distinct appearance of cells.

Connective Tissue.—Dr. Hubrecht has, *loc. cit.*, insisted with great justice on the importance of the "fibro-museular connective tissue," which serves to support the various internal organs by bands of fibres which pass from the body-wall to these organs. In the present species this system is well developed, and, as in other species, is most marked where spaces intervene between the internal organs and the body-wall. Thus fibres constantly bind down the lateral nerve-trunks to the body wall (Fig. 6, F.), and in like manner pass from the body-wall to the dorsal surfaces of the proboscis sheath and digestive tract. But the connective tissue in this species presents a feature which has not hitherto been described, namely, the presence of cells in addition to fibres. These cells are represented in figures 4 and 5 F., and, highly magnified, in Fig. 6 G. and in Fig. 7. These cells are large and of fairly uniform size, though, scattered amongst them, are, as may be seen in Fig. 7, a few of much less magnitude. At parts these cells present the appearance of being connected with fibres, as is the case with the cell B, in Fig. 7. They present a well-marked nucleus and nucleolus, and might at first in female specimens be mistaken for young ova, as they are especially numerous in the vicinity of the lateral nerve trunks. They may with care be traced all round the body internal to the inner muscular coat, being recognizable in a single layer, and having a flattened appearance,

in places where the voluminous digestive tract is in close apposition with the body wall, whereby it makes the recognition of separate fibres out of the question.

Vascular System.—The opacity of this species makes the study of this system very difficult, as no general view can be obtained. In Fig. 3. D. the two lateral vascular trunks are seen in section.

Generative System.—The arrangement of the generative organs presents nothing peculiar. The animal is dicœcious. Fig. 4 represents the general arrangement of the testicular masses, and fig. 5 shows an ovum lying in its sac. In all cases the male organs seem to bear a much greater proportion to the size of the body than do the female. In some sections I have observed the appearance of ducts passing from the testis through the body-wall, but not with sufficient constancy or distinctness to justify any lengthened description.

Digestive Tracts.—The digestive tract has the usual arrangement. The mouth and æsophagus present well marked cilia. The contents of the post-æsophageal portion of the digestive tract has a uniform granular appearance, many of the granules being like oil globules. In none of the specimens examined has anything definite been observed that would lead to a knowledge of what the animal feeds upon, and, in fact, at the time when the specimens were collected, it is very probable that the animals were torpid and not feeding at all.

Beside the *Nemertine*, I was fortunate enough to obtain specimens of a small species of Land *Planarian*, which occurs in situations similar to those in which the Nemertine lives, and, indeed, is often found together with it. Wishing to ascertain where this animal should be placed, and referring to the arrangement of Mr. Stimpson (Proc. Acad. Phil., 1857), I found that he states, under the characters of his sub-family *Geoplanidæ*, that the eyes are two or many situated in the anterior part of the body ("Oculi duo vel plurimi in capite dispositi.") This part of the diagnosis Mr. Moseley (*loc. cit.*) has very properly altered in consequence of his discovery of eyes in various parts of the body in *Bipalium*. The genus *Geoplana*, the first under Mr. Stimpson's sub-family, has amongst its other characters this "ocelli numerosi marginales, v. in acervos submarginales, in capite dispositi." This genus is composed of all the species described by Mr. Darwin (Ann. Nat. Hist., Series i. vol. xiv.), except those which have no eyes, and of one species found and described by Mr. Stimpson himself. But there appears nothing in Mr. Darwin's description to justify Mr. Stimpson using the words "in capite dispositi." For instance, in describing *Planaria vaginuloides* (*Geoplana vaginuloides*, Stimpson), Mr. Darwin says, "Ocelli numerous, placed at regular intervals round the anterior extremity of the body and irregularly round the foot." Again, in the description of *Pl. tasmanica*, "Ocelli scattered round the entire margin of the foot, but most frequent at the anterior extremity," Mr. Stimpson's words "in capite dispositi" must mean, "in capite solum dispositi;" at least Mr. Moseley has taken them to

mean this, and it would be difficult to put any other construction on them. This explanation is necessary, as the planarian which exists in Rodriguez has, like *Pl. tasmanica*, eyes situated round the entire margin of the foot, but more frequent at the anterior extremity. In other respects this agrees in its characters with the genus Geoplana; and it seems to be necessary then to alter the characters of this genus, as Mr. Moseley has done those of the genus *Bipalium*, in order that the former may include Mr. Darwin's species and the present one. The latter I propose to name *G. whartoni*, after my friend Commander Wharton, R.N., lately in command of H.M.S. "Shearwater."

Geoplana (altered from Stimpson).

Corpus depressum, vel depressiusculum, elongatum v. lineare, capite continuo. Ocelli numerosi, marginales, v. submarginales; v. in parte anteriori corporis solum, vel passim circa corpus, singulatim plerumquc, nonnunquam in acervos dispositi.

G. whartoni,—Pl. LV., fig. 1.

Body elongate, pointed at both ends. Eyes numerous, placed singly all round the margin of the foot, but most numerous at the anterior extremity. Body cream coloured, and marked with three dark longitudinal stripes, one median and two lateral, which latter converge towards the extremities and meet the median one. Mouth placed behind the centre of the body. Generative orifice nearer to the posterior end of the body than to the mouth. Body one inch to an inch and a half long when extended, much less when at rest.

Habitat.—In the island of Rodriguez on rotten wood. Mr. Darwin mentions (*loc. cit.*) that he found a Land Planarian at Mauritius. In the island of Mahé in the Seychelles group, I observed an animal of similar size and colour, which unfortunately became dry before I had time to examine it.

Description of Plate LV.

Fig. 1.—*Geoplana whartoni*, sp. nov., about twice the natural size, from a specimen preserved in alcohol.

Fig. 2.—*Testrastemma rodericanum*, sp. nov., about three times the natural size, from a specimen preserved in alcohol.

Fig. 3.—Transverse section through the anterior part of the body of a specimen of T. Rodericanum. Hartnack's Obj. 2. Drawn with the camera lucida, as were also the succeeding figures.

A. Cuticular and muscular layers of the body-wall. B. Œsophagus. C. Proboscidean sheath. D. Vessels. E. Lateral nerve trunk. F.F. Cephalic glandular mass.

Fig. 4.—Transverse section through the middle part of the body of a male individual of the same species. Hartnack Obj. 4.

A. Cuticle. B. Circular muscular coat. C. Longitudinal muscular coat. E. Testicular masses having well defined walls, enclosing cells and spermatozoa. F. Connective tissue, consisting of cells and fibres. G. Portion of intestinal tract with granular contents.

Fig. 5.—Similar section through a portion of the body of a female. A, B, C, D, F, G, as in the preceding figure. E. an ovum contained in its sac, and possessing a well marked nucleus and nucleolus.

Fig. 6.—Transverse section of lateral nerve trunk, highly magnified. Hartnack's Obj. 8.

A. Dorsal cellular region. B. Ventral cellular region. C. Dorsal fibrillar region. D. Ventral fibrillar region. E.E. Fibres running into the fibrillar masses, probably consisting mainly of connective tissue, but perhaps in part of processes from the cell regions. F. Fibrous bands binding down the cord. G. Connective tissue cells. H. Internal muscular coat.

Fig. 7.—Portion of a transverse section highly magnified, to show the connective tissue.

A. Int. muscular coat shown in outline. The fibres represented passed between it and a portion of the digestive tract. D. Fibres of connective tissue. B. A large connective tissue cell, with fibre attached, other cells mostly large, but some small are also seen.

Fig. 8.—Section through a portion of the extended proboscis to show the arrangement of the "beaded layer." Hartnack. Obj. 8.

A. Internal circular muscular coat. B. External circular muscular coat. C. Internal longl. muscular coat. D. External longitudinal muscular coat. E. One of the great longitudinal bands surrounded by fine wavy fibres, and also divided by similar fibres which pass through it; all these fibres go to constitute the circular elastic coat. F. The circular elastic coat.